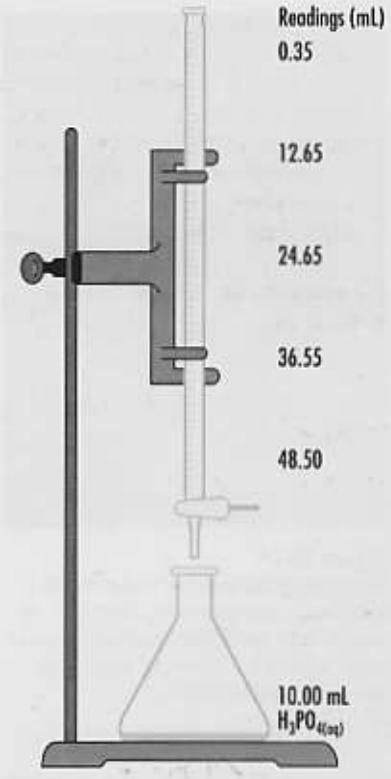

Figure 15.27
Sodium hydroxide titrant is added in successive trials to a phosphoric acid sample.

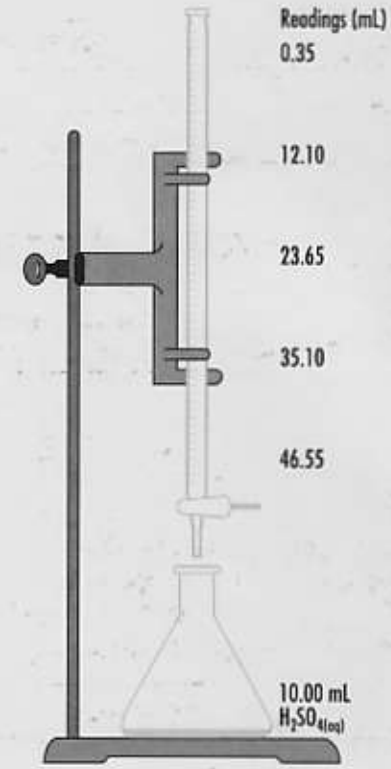

Figure 15.28
Sodium hydroxide titrant is added to a sulfuric acid sample in successive trials.

Exercise

42. In a chemical analysis, only one quantitative reaction could be detected in the pH curve for the reaction of sodium sulfite with hydrochloric acid. In a subsequent titration, 10.00 mL of sodium sulfite solution was titrated with 0.225 mol/L hydrochloric acid. The average volume required at the endpoint for this titration was 14.2 mL. What is the concentration of the sodium sulfite solution?
43. Chemical analysis of a stain remover containing oxalic acid was conducted by a commercial analytical chemistry firm. Oxalic acid solution was titrated with 0.485 mol/L potassium hydroxide to the second endpoint, using phenolphthalein (Table 15.4). Calculate the concentration of the oxalic acid in this brand of stain remover.
44. A 25.0 mL sample of a cleaning solution, containing sodium hydrogen sulfate, was titrated with 0.500 mol/L sodium hydroxide using phenolphthalein indicator. At the endpoint, one drop of $NaOH_{(aq)}$ was sufficient to change the phenolphthalein indicator from colorless to pink. At this point, a stoichiometrically equivalent 10.2 mL of $NaOH_{(aq)}$ had been added. What is the concentration of sodium hydrogen sulfate in the cleaning agent?
45. A titration of phosphoric acid used in a commercial rust-removing solution with 0.123 mol/L sodium hydroxide was completed to the end of the second quantitative reaction. The equivalence point values are obtained from Figure 15.27. What is the concentration of the phosphoric acid solution?

    $2\,NaOH_{(aq)} + H_3PO_{4(aq)} \rightarrow 2\,H_2O_{(l)} + Na_2HPO_{4(aq)}$
46. In a chemical analysis, 10.00 mL samples of sodium sulfide solution used in an industrial process were titrated with 0.150 mol/L hydrochloric acid to the end of the second quantitative reaction. An average of 16.8 mL of $HCl_{(aq)}$ was required. What is the concentration of the sodium sulfide solution?
47. A titration of sulfuric acid with 0.484 mol/L sodium hydroxide was completed to the second endpoint. The evidence is displayed in Figure 15.28. Evidence from pH curves indicates that the reaction of sulfuric acid with the sodium hydroxide involves two quantitative reactions. Calculate the concentration of the sulfuric acid solution.

Table 15.4

TITRATION OF 25.0 mL OXALIC ACID WITH POTASSIUM HYDROXIDE

Trial	1	2	3
Final buret reading (mL)	17.1	32.7	48.3
Initial buret reading (mL)	1.4	17.1	32.7